

Physics 1 (H) QUIZ

NEWTON'S LAWS

Name: KEY.

Directions: Show all work and circle all of your final answers. Good Luck!

Section I: Multiple Choice (1.5 points each.) Circle the most correct response:

1. Which of the following situations describes inertia?:

- ☒ a) A stationary object tends to resist being moved
- ☒ b) A moving object tends to resist a change in speed
- ☒ c) A moving object tends to resist a change in direction
- ☒ d) All of the above

2. A force of 180. Newtons acts on an object that has a mass of 200. grams. What is the acceleration in m/s^2 of the object?

- ☒ a) 900. m/s^2
- ☒ b) 0.900 m/s^2
- ☒ c) 36 m/s^2
- ☒ d) $3.6 \times 10^4 \text{ m/s}^2$

3. A batter strikes a baseball with a bat. Identify an action-reaction pair and describe the forces exerted by each.

- ☒ a) The batter exerts a force on the bat; the ball exerts a force on the bat.
- ☒ b) The batter exerts a force on the bat; the bat exerts a force on the batter.
- ☒ c) The bat exerts a force on the batter; the bat exerts a force on the ball.
- ☒ d) The ball exerts a force on the bat; the bat exerts a force on the batter.

4. A force of 50 N is applied to an object and the object accelerates at a rate of 5 m/s^2 . What is the mass of the object?

- ☒ a) 10 N
- ☒ b) 10 kg
- ☒ c) 250 kg
- ☒ d) 25 kg

Section II: Short Answer (2 points each)

5. Describe Newton's First Law and provide an example to demonstrate this law:

AN OBJECT IN MOTION STAYS IN MOTION
OBJECT AT REST STAYS AT REST
UNLESS ACTED UPON BY AN EXTERNAL FORCE (UNBALANCED)

6. Describe Newton's Second Law and provide an example to demonstrate this law:

$$F = ma$$

7. Describe Newton's Third Law and provide an example to demonstrate this law:

FOR EVERY ACTION THERE IS AN EQUAL & OPPOSITE REACTION.
ACTION / REACTION!

8. You are in space and all that you have with you is your tool bag. There are no forces currently acting on you and you are hovering about 100 meters from the spaceship and need to make it back safely. What do you do? Which of Newton's Laws guarantees that this will work?

PUSH BAG IN OPP DIRECTION.
3rd LAW

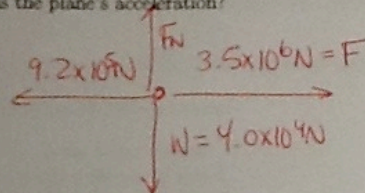
9. Explain the difference between mass and weight:

MASS: AMOUNT OF MATTER IN AN OBJECT. INHERENT

WEIGHT: GRAVITATIONAL FORCE ON AN OBJECT!

Section II: Problems Answer the following questions and circle the final answers. Be sure to show ALL work and draw the appropriate diagrams.

Problem 1. (5 points.) A plane that weighs 4.0×10^4 N is accelerating to take off on a runway. The force of the plane's engine is 3.5×10^6 N and the force of friction on the plane is 9.2×10^5 N. What is the plane's acceleration?



$$N = mg$$

$$m = 4077 \text{ kg}$$

$$F_{\text{NET}} = 3.5 \times 10^6 - 9.2 \times 10^5 = 2.58 \times 10^6 \text{ N}$$

$$F = ma \Rightarrow a = 632.8 \text{ m/s}^2 \Rightarrow a = 6.3 \times 10^2 \text{ m/s}^2$$

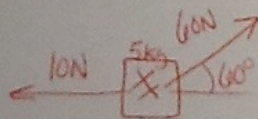
Problem 2. (3 points.) A crane is lifting a 1.0×10^4 kg mass at a constant velocity. What is the force that the crane is pulling up on the mass?

$$F_{\text{crane}} = (1.0 \times 10^4 \text{ kg})(9.81)$$

$$= 98100$$

$$9.8 \times 10^4 \text{ N}$$

Problem 3. (5 points.) A force of 60.0 N directed at an angle of 60° with the horizontal is applied to a crate. If the frictional force acting on the crate is 10.0 N and the crate has a mass of 5 kg, find the magnitude of the acceleration of the crate. If the crate started from rest, how far will it travel in 12.0 seconds?



$$F_{\text{NET}} = 60 \cos 60 - 10 = ma$$

$$a = 4 \text{ m/s}^2$$